Portage Creek

Dewatering Cost Benefit Analyses

Purpose:

The purpose of this cost benefit analyses is to demonstrate if there is a cost benefit to using isolation area perimeter dewatering using vacuum groundwater extraction as opposed to conventional "sump and pump" dewatering or wet dredging of the SA6 Removal Area of the Portage Creek Project.

Summary of Approach Tactics

General Approach Note

All three approach tactics will require subdividing the SA 6 Removal Area into multiple isolated sections that will have sheet pile cofferdams upstream and downstream that will permit by-pass pumping of the creek flow around the isolated sections. While there has been developments that will affect the approach described in "Technical Memorandum for SA6 Contaminated Sediment Removal" dated December 2011, the cost benefit analyses will developed as if all sections SA6-14 will be addressed as if the overall area will be divided into 3 isolation areas of near equal size. The table below summarizes the SA 6 section information:

Table 1. Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA6-1	29.5'W by 71'L	18"	0/0	2094 sf/116 cy
SA6-2	33.5' W by 69' L	18"	0/0	2311 sf/128 cy
SA6-3	36'W by 64' L	30"	0/0	2304 sf/213 cy
SA6-4	34' W by 70' L	30"	0/0	2380 sf/220 cy
SA6-5	30' W by 76' L	36"	0/0	2280 sf/253 cy
SA6-6	30' W by 79' L	36"	0/0	2370 sf/263 cy
SA6-7	37.5' W by 60' L	18"	0/0	2250 sf/125 cy
SA6-8	42' W by 67' L	18"	0/0	2981 sf/166 cy
SA6-9	44.5' W by 56' L	18"	0/0	2492 sf/138 cy
SA6-10	42.5' W by 57' L	18"	0/0	2422 sf/135 cy
SA6-11	38' W by 57' L	18"	0/0	2166 sf/120 cy
SA6-12	37.5' W by 57' L	30"	0/0	2137 sf/198 cy
SA6-13	37 W by 64' L	30"	0/0	2368 sf/219 cy
SA6-14	37' W by 56' L	30"	302 sf/ 28 cy	1770 sf/164 cy

This cost benefit analyses will assume that the sections shaded in red in the table above SA6 1-4 represent the first isolation area, SA6 5-9 shaded in blue represent the second isolation area, SA6 10-14 shaded in orange represent the third isolation area. The SA6 1-4 isolation area is approximately 274 feet in length and will require approximately 677 cubic yards of excavation. The SA6 5-9 isolated section is approximately 338 feet in length and will require approximately

945 cubic yards of excavation. The SA6 10-14 isolated section is approximately 291 feet in length and will require approximately 836 cubic yards of excavation.

EQ assumes that 4 cofferdams will be installed prior to excavation. There completion elevation is only 6 inches above mean stream elevation allows for by-pass pumping into the next down gradient isolation cell, or completely around entire dredging area if extra piping costs are less than relocating pumping discharge runs. EQ has assumed pulling the upstream sheet wall at completion of each isolated section and relocating by pass pump to just upstream of the next isolated cell. EQ did not include the cost of sheet pile installation into the 3 cost estimates for dredging methods as this is a fixed cost that all 3 approaches would require and is not relevant to the cost analyses.

The cost analyses will focus on cost that is relevant to completion schedule for each approach and/or fixed cost associated with the respective operational approach.

Excavation using Perimeter Dewatering of Isolated Area

This approach will require installation of a series of 2 inch by 20 foot deep SilterVac vacuum wells on 15 foot centers along both sides of the creek, each with 3 feet of geotextile filter assembly around the bottom of the SilterVac well. In addition a series of ¾ inch by 20 foot SilterVac vacuum points would be installed at 5 foot centers across the creek perpendicular to the 2 lines of SilterVac wells to divide the SA6 area into 3 isolation sections. The vacuum wells/points will be connected to an 8 inch header pipe which will be connected to a diesel powered pump. The discharge pipe would be extend from the pump to the downstream end of SA6 work area where flow would spill out on a floating velocity dissipating pad in the middle of the creek to eliminate the possibility of erosion. The isolated area will be dewatered form the bottom 3 feet drawing water down. Dewatering in this fashion should leave contaminates in the upper sediments and water is expected to be suitable for direct discharge back to the creek. Therefore no water treatment element is required for this process, except for water accumulation on the John Street TCRA staging pad resultant from weather related precipitation contacting staged sediments.

Excavation would be performed with PC 200 Kamatsu Long Reach Excavator (or equivalent) with a 50 foot reach. Excavation would basically be performed in a manner described the "Technical Memorandum for SA6 Contaminated Sediment Removal" dated December 2011. EQ only has past experience using this dewatering approach for other applications. While EQ expects that little to no free water will remain in the sediment, it will be assumed for the cost benefit analyses that a 5% addition of solidification media will be required to prepare the sediments for transport from SA6 work area to the John Street TCRA Staging Pad. Therefore this will be considered when estimating excavation time, amount of solidification material required, and additional tonnage/volume for disposal. The cost estimate for this portion of work will include 123 cubic yards of solidification material. This cost estimate account for 2,458 cy of disposal of contaminated sediment (Note this is a higher volume than the FIELDS group estimate, and is based off take off measurements from EPA provided figures) and the 123 cy of solidification media for a total of 2,581.

The general approach steps for this method are as follows:

1. Installation of pumping system will begin once the first section is isolated with cofferdams and by-pass pumping system is operational. This will require 1 week for installing pumping system.
2. Initial pumping of first isolated area will require about 2 weeks before excavation can begin. Pumping of the second isolation will lag 2 days after the first isolation area.
3. Excavate first isolation area, solidify, load and ship to John Street TCRA Staging Area using 1 long reach excavator, solidify as needed in creek bed with Corn Cob pellets, and transfer to staging area with (4) 10 cy dump trucks. Long reach excavator will solidify sediment and stockpile on creek bank and a second excavator will be used to load trucks. Corn cob pellets will staged by excavator with rubber tire loader with forks in cubic yard bags. EQ expects to excavate/solidify/load and ship a minimum of 4 (10 cy) truck loads per hour over an 11 hour excavating/ 12 hour work day. Therefore, EQ expects to complete the first isolation area in 2 days
4. Verification sampling of will be performed on the first isolation area.
5. Toe of slope restoration will then be performed that will include geotextile underlayment on the creek bank/floor. This will be followed by rock placement along creek banks to stabilize the bank toe. EQ assumes this process will be completed at faster rate than other 2 approaches because of work being performed in a dry environment, thus simplifying geotextile installation and rock placement due to better visibility and working conditions for laborers. EQ would then backfill the remainder of the stream bed with a sand/gravel mixture to prescribed elevations.
6. The upstream sheet wall will be removed at isolation cell completion, and by-pass pumping equipment will be reconfigured as needed.
7. Steps 1-6 will be re-performed for the following 2 isolation cells

Please note that EQ utilized rough order of magnitude estimate from Griffin Dewatering to determine cost for vacuum system installation and restoration, as well the completion time estimates for installation and dewatering. The system provided in the estimate has the flexibility to dewater multiple sections concurrently once an initial drawdown in one isolated area is substantially complete. This is reflected on the attached schedule for Vacuum Dewatering Scenario.

Excavation using Sump Dewatering of Isolated Area

This method will require substantial site preparation and hardware operation not common to the other 2 approaches. A waste water treatment plant with operating capacity of 1,000 gpm and a 10 inch HDPE pipeline to transfer water recovered from excavation area will need to be constructed and operated to support excavation operations. EQ will utilize similar personnel and equipment to perform excavation and solidification, however additional personnel, equipment, materials, and level of effort will be required to conduct excavation in this manner. The steps will be similar to those described above with exception of dewatering. EQ would use an 8 inch pump to dewater standing water from the isolation cell into a frac tank at the excavation site. That pump will then be used to pump water from a sump excavated in the downstream end of the isolation cell to remove influx of groundwater recharge to the isolated cell. A 8 inch booster pump would be used to transfer water accumulations in the frac tank via the 10 inch HDPE pipeline to the WWTP. An additional difference is the solidification approach, EQ would require mixing boxes to perform solidification and assumes a 15% solidification media addition rate based on past historical practices.

Wet Excavation Method

EQ will follow the general approach described below:

The Wet Dredging Approach will be conducted as follows:

1. Standing water in the isolated section will remain in place during the contaminated sediment removal process.
2. EQ will utilize a long reach excavator equipped with an RTK-GPS system and a hydraulic clam shell bucket to perform excavation of the isolated area from atop of the creek bank. The RTK-GPS system will allow the operator to precisely determine where excavation has taken place to total depth even though turbid water conditions may prevent visual verification. The clam shell bucket allows for removal of sediment without a significant collection of water. Work will begin at the upstream end of the isolated area and progress downstream as sediments are removed to target depth for respective portion of the isolated section.
3. EQ will utilize (2)20 cubic yard (CY) rock boxes to place exhumed material into for solidification and load out. The boxes will be positioned side by side at top of bank downstream from the long reach excavator when working from the west bank and upstream from the excavator when working from the east bank. This will allow for a clear field of view for the long reach operator when swinging the machine to place material in the box(es). A second excavator will be positioned on the opposite end of the boxes to solidify exhumed material and load into transfer trucks to material John Street TCRA Staging Pad. The boxes will be placed on plastic sheeting with sufficient surface area to allow an apron to extend down to the creek's edge. This will permit any water/sediment spillage to gravity flow back into the excavation area, and thus minimize environmental impact to the work bench on top of the creek bank.
4. The long reach excavator will place approximately 10-12 cy of sediment into the box in preparation for latent water extraction and solidification. This will allow for 40-50% freeboard space to allow for addition and mixing of solidification agent.
5. As material is being placed into a box and shortly after, a screened pump hose will be placed into the box to extract latent water recovered with sediment. This water will be pumped into a frac tank for accumulation and settling, and subsequently transferred with a centrifugal pump via constructed pipeline to the waste water treatment plant located at the John Street TCRA Staging Area. EQ may use either a pneumatic powered diaphragm pump, or vacuum pump to recover latent water from 20 cy rock boxes. These pump types are preferred because they do not require priming and several inches of standing water to maintain pumping. A laborer will move the hose end around in the box as

needed to recover the maximum amount of water available prior to adding a solidification agent.

6. Solidification with the second excavator will begin once a box is filled and latent water is evacuated. EQ will either Calciment/Corn Cob based Sorbant media/desicant based polymer to absorb water saturated within the sediment. Material will be provided in cubic yard super sacks that will staged near solidification area. The second excavator will lift a super sack of solidification material and dispense material through a bottom chute into the rock box. The chute opening will be positioned just above the sediment in the box to minimize media fall distance and thus minimize dust release into atmosphere. Water mist spray may need to be performed on windy days as dust control measure. This will be performed by the same laborer performing latent water evacuation using either a pressure washer, or garden hose spray nozzle with booster pump from a clean water tank staged close to work area. The operator will mix material thoroughly until no sign of free water is present.
7. A fork truck or rubber tire loader with forks may be used to bring additional solidification media from a remote storage area to supplement material staged close to mixing and solidification operations.
8. Solidified material will be loaded into dump trucks in manner as previously described in respective Technical Memorandum and sent to the John Street TCRA Staging Area.
9. Restoration of toe bank and backfilling will be completed prior to moving to next isolated cell. This process is assumed to take longer than the vacuum dewatering approach because of the inherent difficulties of placing geotextile and rock in standing water.
10. The upstream sheet wall would be removed and by-pass pumping system reconfigured as needed.

This process would be repeated for each isolation cell as with the other 2 methods. EQ utilized rough order of magnitude pricing for the long reach excavator with RTK-GPS system and 2 cubic yard clam shell bucket provided by White Lake Dock and Dredge of Whitehall Michigan. The daily price provided in the respective cost estimate is based them providing the machine operated at a cost to EQ of $350/hour, and EQ would provide fuel, per diem, and lodging for the operator.

Summary

The result in the cost benefit analyses is summarized below:

Method	Cost
Vacuum Dewatering	$586,208.87
Wet Dredging	$609,500.01

Conventional Dewatering $719,167.85

This estimate is supported by attached Excell spreadsheets file entitled Cost benefit Analyses Cut 2, Rev Vacuum dewatering scenario, Rev wet Dredge Scenario, and Rev Conventional dewatering scenario. EQ contract standard rates were used to develop the associated cost estimates to simplify the estimating procedure, which mainly pertains to not breaking out cost for SCA vs. DBA activities. EQ believes the end result would be proportionally correct if DBA rates were incorporated.